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[0008]

[Embodiments]

Embodiment of the present invention is explained in detail below with reference to accompanying drawings. Fig. 1 is a diagram illustrating a constitution of an optical disk device to which the present invention is applied. An optical disk 5 is a removable recording medium such as DVD and thus it does not compose the optical disk device. Further, a lens 4 and an actuator 6 compose an optical head.

[0009]

As to commands and information from a high-order host, the commands are decrypted and the recording information is modulated by a controller 19, and they are converted into code columns which are compatible with an adopted modulating system. In order to eliminate a difference between a speed of transmitting information from the high-order host and a speed of recording information in the optical disc 5, a buffer memory 22 that temporarily retains information from the high-order host is provided. Since

recording of information in the optical disk 5 is conducted per constant unit amount, information is stored in the memory buffer 22 until the constant amount of information is transmitted from the host. Further, in order to enable the recording to be started immediately after the optical head comes to a recording start position, while the optical head is moving to a position where the recording can be started and thus the information cannot be recorded in the optical disk 5, the information from the host is stored in the buffer memory 22, so that the recording time is shortened.

[0010]

Further, in a servo mechanism that controls a position of an optical spot of light beam for recording/reproducing information, since a photodetector 7 acquires a focus error signal and a track error signal, these error signals (not shown) are input into the controller 19, and a servo signal is output from the controller 19 into a servo driving circuit 18 and a driving current is supplied to an actuator 6. As a result, the optical lens 4 is moved, so that the position of the optical spot is controlled.

[0011]

Further, when information is recorded, the information from the controller 19 is input into a recording pulse generating circuit 15 and is converted into a recording pulse column for controlling a length and a width of a recording mark.

[0012]

The recording pulse column converted in the recording pulse generating circuit 15 is firstly input into a laser driver 14, and the recording current supplied from the laser driver 14 oscillates a semiconductor laser 1

so that a high output is produced. The light output from the semiconductor laser 1 is converted into parallel light by the optical lens 2, passes through the prism 3, and converged onto the optical disk 5 by the optical lens 4, so that a recording mark corresponding to a code column of the recording pulse column is recorded.

[0013]

Fig. 2 illustrates one example of a physical constitution of the optical disk 5. As to a physical address 32, an address is formed as unevenness at the time of shaping an optical disk. User data and various management data are recorded in a data area 33. In the optical disk 5, the physical addresses 32 and the data areas 33 are formed on tracks 31 so as to be arranged concentrically or spirally. This diagram shows an example where they are formed concentrically. The optical spot is tracing the track 31 and simultaneously reads the physical address 32. Further at the time of recording/reproducing, data are recorded and reproduced in/from the data area 33.

[0014]

Fig. 3 illustrates an example of the physical constitution of the optical disk. Information such as user data and various management data is recorded in a user data area 34. A replacement area 36 is an area where when the user data area 34 is defective, information such as user data and management data is recorded on instead. A defective address registration area 35 is an area where a defective physical address in the user data area 34 is recorded. Further, information about whether a replacement area of the user data is secured for defective is also recorded in the defective address

registration area 35.

[0015]

In the optical disk device shown in Fig. 1, in the case where the position of the optical spot is not controlled and also the rotation is stopped at the time of unconducting recording/reproducing, when information is read and written at next time, the optical spot is converged onto the optical disk 5 and is controlled so as to come to the track where the information is recorded, and its physical address is read so that the position of the optical spot on the optical disc is known, and then the optical spot is located in the address where the information is desired to be read and written, thereby arising a problem such that this takes a very long time.

[0016]

On the other hand, since the recording/reproducing speed with respect to the optical disk 5 is not constant because of a rereading operation and the like due to failure of data reading, the recording/reproducing time in the case where rereading/rewriting due to the failure of the data reading/writing is not conducted is shorter than the recording/reproducing time which should be secured for recording/reproducing real-time data such as a moving image. For this reason, even when the real-time data such as a moving image are sequentially recorded/reproduced, if the recording/reproducing in/from the optical disk 5 is not failed, a state where data are not recorded/reproduced in/from the optical disk 5 is frequently generated.

[0017]

Even when the recording/reproducing is not conducted, the optical

spot sequentially, traces the track 31 for recording data on the optical disk 5. When next recording/reproducing is conducted, since the position of the optical spot is already acquired, the optical spot can be started to be located in a target address immediately. According to this operation, the recording/reproducing speed of data is prevented from being lowered.

[0018]

The physical address 32 is, therefore, read when the optical spot traces in the case that the recording/reproducing is not conducted. If a portion where the physical address 32 cannot be read, the physical address 32 as the defective address on the optical disk is registered in the defective address registration area 35.

[0019]

Even when the physical address can be read, a next operation is performed so that a defect detecting ability can be further improved. In the optical disk device in Fig. 1, when the optical spot traces in the case where the recording/reproducing is not conducted, a part of incident light is reflected from a recording/reproducing surface of the optical disk 5, and the reflected light enters the photodetector 7 via the prism 3. . An output from the photodetector 7 is input into a reflected light amount abnormality detecting circuit 12 via a preamplifier 8. The reflected light amount abnormality detecting circuit 12 compares intensity of the reflected light at the time of recording with a predetermined determination level, and as a result, when the intensity of the reflected light is less than the determination level for a predetermined period, the circuit 12 determines an error on the optical disk 5, and an error output is maintained in a hold circuit 12b.

[0020]

The controller 19 checks an output from the reflected light amount abnormality detecting circuit 12 and an output from a vibration detecting circuit 21 simultaneously with the time when tracing of the track for recording unit such as 1 sector or 1 block is ended. At this time, when only the output from the reflected light amount abnormality detecting circuit 12 has an abnormal value, an address of a defect registration unit including the physical address of the recording area is registered in the defective address registration area 35. On the other hand, when the output from the vibration detecting circuit 21 also has an abnormal value, the error is not the optical disk 5, the determination is made that the information cannot be recorded due to vibration of the optical disk device, and thus the address for detect registration unit is not registered in the defective address registration area 35.

[0021]

In Fig. 4, the above operation is expressed by a flowchart. The process in Fig. 4 is performed not in a recording/reproducing state but in a recording/reproducing process standby state. A counter value i for counting errors is cleared at step 401, and the physical address 32 is read at step 402. When the physical address 32 can be properly read, the steps 401 and 402 are repeated, and ability/disability of the reading of the following physical address 32 is checked. When the sequence reaches the final physical address 32, the process is ended. When the sequence reaches the final address, the sequence may return to the first address so that the check may be conducted.

[0022]

When the physical address 32 is not properly read, the counter value i is increased by 1 at step 403. A determination is made at step 404 whether an address of defect registration unit including the physical address 32 which is tried to be read is registered defectively. When it is registered defectively, this place is not already used, the sequence returns to step 401, namely, to the beginning of the process, so that next physical address 32 is read. When the address not registered defectively, the error count value i is compared with a prescribed number of times N (N: a constant larger than 1) at step 405. The prescribed number of times N is a numerical value with which when the physical addresses 32 cannot sequentially read N times, a determination is made that data error is generated. N is arbitrarily set within a range where an error can be corrected by an address complementing function or a data correcting function of the optical disk device even if the physical addresses 32 and the user data cannot be read.

[0023]

When the error count value i does not reach the prescribed number of times N, the sequence returns to step 402, the next physical address 32 is read. When the error count value i reaches the prescribed number of times N, the address of defect registration unit including the physical address 32 which is tried to be read currently is recorded in the defective address registration area 35, and the sequence returns to step 401.

[0024]

Further, when the physical address 32 can be read at step 402, the sequence does not immediately return to step 401, and abnormality of the

reflected light amount is detected at step 407. When abnormality is present, the sequence returns to step 401, and when abnormality is not present, the sequence returns to step 404 so that defect of the user data area 34 can be registered and the speed at the time of later recording can be heightened.
[0025]

Not shown in the drawing, but step 407 is executed after step 401, and when the reflected light amount is abnormal, step 401 may be executed, and when it is not abnormal, the steps after step 403 may be executed.
[0026]

When defect is registered according to the above routine, a data area in the case where data of the defective address are recorded in another area is not secured, and an identifier which represents that another area is not secured may be recorded. At the time of reproduction, even if defective recording is conducted by the above operation, a determination can be made by the defect registration information that user data are not written in a replacement area according to the identifier. Even if defective recording is conducted, therefore, data which are originally recorded can be read.
[0027]

In such a manner, in the optical disk device according to the embodiment, a free time at which information is not recorded/reproduced is utilized so that the defect in reading of the physical addresses 32 or defect in the reflect light from the optical disk is detected, and when it is detected as defective, an address where the error is present is registered in the defective address registration area 35. When recording is actually conducted, the address which is already determined as defective is acquired from the

defective address registration area 35, so that information is not recorded in this address. For this reason, the frequency that data are written in a defective place and thus an error is generated so that various error processes such as rewriting are executed is reduced, and thus the data writing process can be executed at a high speed.

[0028]

[Effect of the Invention]

According to the present invention, the time at which recording/reproducing is not conducted is used for detecting of defect, an encounter rate of defect at the time of recording/reproducing can be reduced, so that information can be recorded/reproduced at a high speed.

Fig. 1

1. Optical disk
2. Servo driving circuit
3. Prism
4. Photodetector
5. Power monitoring circuit
6. Lens
7. Laser
8. Laser driver
9. Recording pulse generating circuit
10. Controller
11. Buffer memory
12. Actuator
13. Lens
14. Photodetector
15. Preamplifier
16. Reflected light amount defect detecting circuit
17. Level determination
18. Hold circuit
19. Data
20. Host
21. Vibration sensor
22. Vibration detecting circuit
23. Filter
24. Lever determination

25. Hold circuit

Fig. 2

1. Data area

2. Physical address

3. Track

Fig.3

1. User data area

2. Defective address registration area

3. Replacement area

Fig.4

1. Normal

2. Read physical address

3. Normal

4. Reflected light is normal level

5. Abnormal

6. Abnormal

7. Defective registration is already conducted

8. N is allowable number of sequential physical address reading error and integer which is 0 or more

9. Identifier which represents that address of block including unreadable physical address and replacement data area are not secured is recorded in defect registration area

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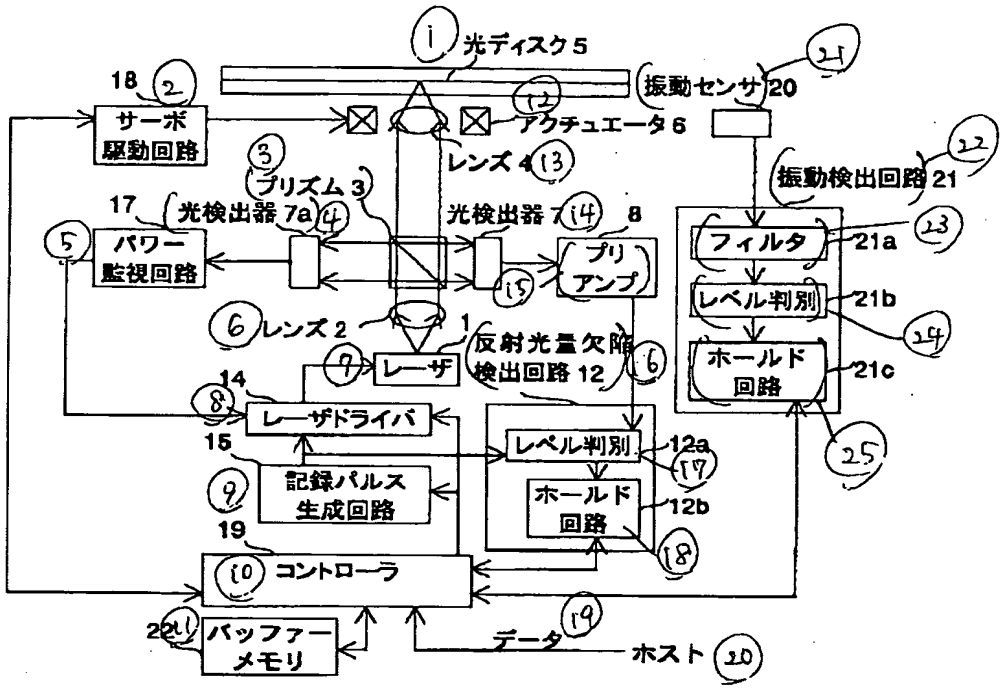
２ａ…レベル判別回路、１２ｂ…ホールド回路、１４…レーザドライバ、１９…コントローラ、２０…振動センサ、２１…振動検出回路、２１ａ…フィルタ回路、２１＊ｂ…レベル判別回路、２１ｃ…ホールド回路、２２…バッファーメモリ。

8

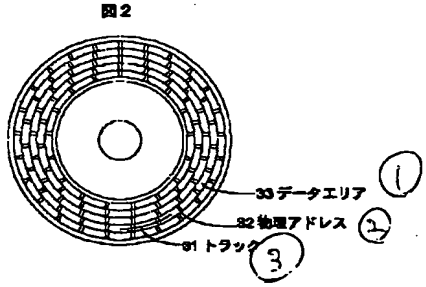
【図１】

図１



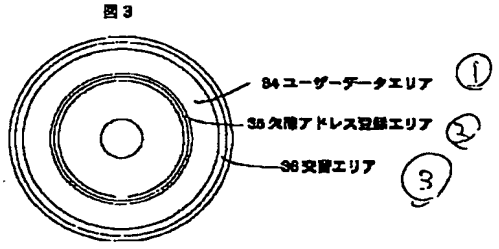
【図２】

図２



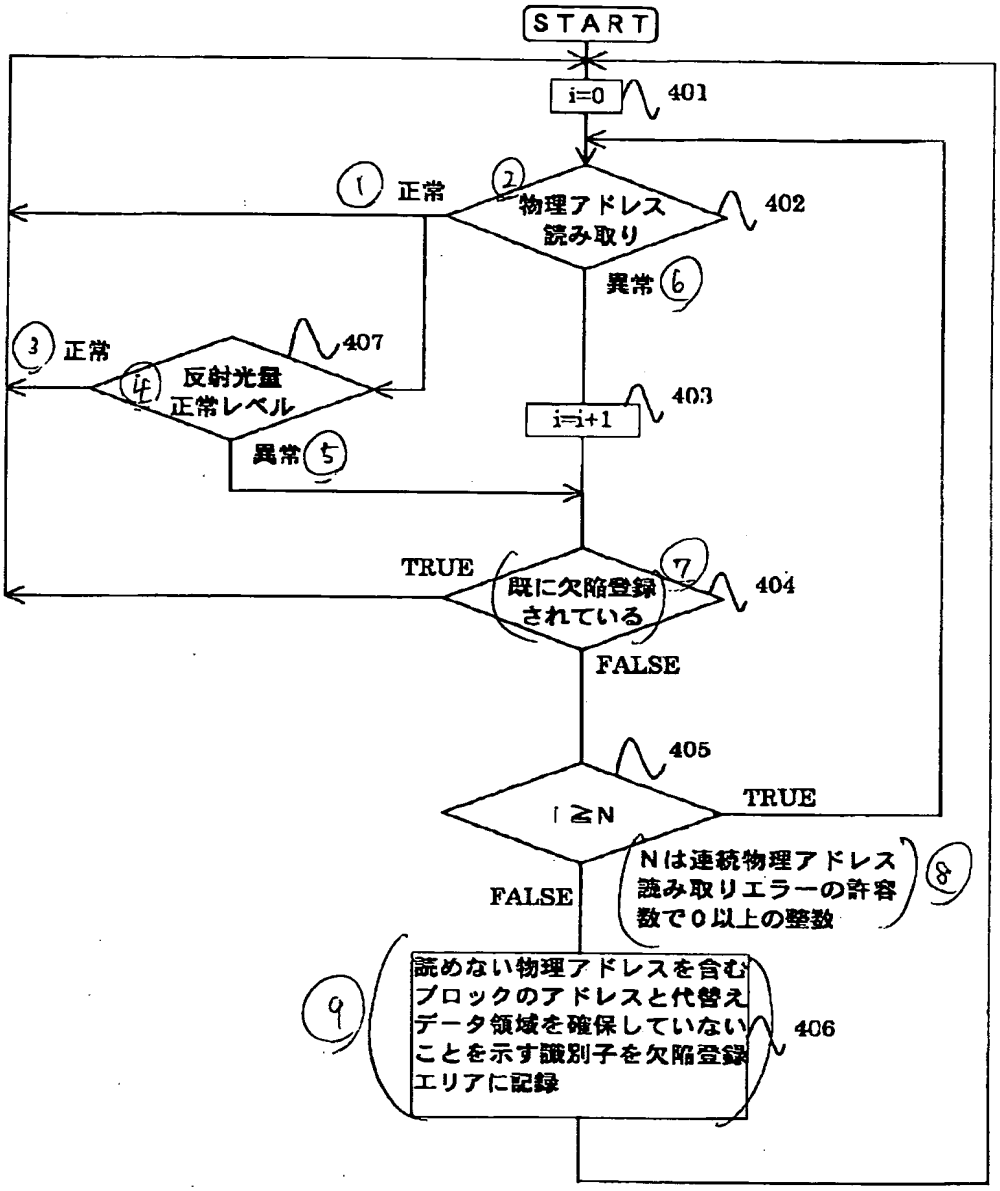
【図３】

図３



【図４】

図４



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